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EDITOR

ERADICATION OF SALT MARSH MOSQUITOES.

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San Francisco Bay is a large area almost surrounded by salt marshes, of which approximately 120 miles of water frontage is under mosquito control. This work has been carried on for some years by five working districts. An additional district is now in the course of organization. These districts are as follows: Contra Costa Mosquito Abatement District (control work to commence in 1927); Napa County Mosquito Abatement District (organized 1926, 90 square miles); Marin County Mosquito Abatement District (organized 1916, 125 square miles); Three Cities Mosquito Abatement District (organized 1915, 80 square miles); Pulgas Mosquito Abatement District (organized 1915, 84 square miles); Matadero Mosquito Abatement District (organized 1915, 64 square miles). There is, then, under control the large area of 443 square miles, which consists of broken hill land and marshes.

The above districts operate under the Mosquito Abatement Act passed by the California legislature in May, 1915. Previous to this, control work had been carried on in Marin County and San Mateo County for a period of years, dating back to 1905, when it was inaugurated under Professor H. J. Quayle of the University of California.

These earlier control efforts demonstrated the need of an adequate measure for the financing of abatement work. Comprehensive control work in San Mateo, Burlingame and Hillsborough, financed by the three cities themselves, led to the actual drafting of the Mosquito Abatement Act in 1915.

To organize a district it requires a petition to the board of county supervisors signed by 10 per cent of the registered voters of the district, which may be so extensive as to cover a whole county. All municipalities desiring to enter the proposed district must have such proposals accepted by their councils, after which the petition goes to the board of county supervisors, which holds a hearing when the petition is considered and all persons interested may appear and be heard. If the board of supervisors decides to create the district, it appoints a board of trustees to serve without pay. This board of trustees has complete charge of the abatement work, which is usually carried out by the appointment of a full-time superintendent, who hires whatever help he may require to do the work. The county is then empowered to levy taxes for this abatement work not to exceed 10 cents on $100 assessed valuation.

In the bay region of San Francisco, the tax averages 8 cents on the $100, and this has been found to be adequate to finance all the work required. This has been found to be true in all the mosquito abatement districts in California with the exception of a few sparsely inhabited districts where the districts are small and the tax limit insufficient.

The above districts are spending around $50,000 annually for control work, divided as follows:

Napa	$12,000
Marin	13,000
Three Cities	9,500
Pulgas	10,000
Matadero	8,000
Total	$52,500

NOTE.—A large portion of the above money is being spent on permanent improvements, such as levees, drainage systems, tide gates, plowing of cracked land, etc.

The above list does not include the other mosquito abatement districts in California, numbering twelve, which have been organized for the purpose of malaria control. These malaria districts have been operating for some time and are apparently successful in reducing the malaria morbidity.

PROBLEMS ENCOUNTERED.

The chief problem is the control of *Aedes dorsalis* and *Aedes squamiger*. These two species are migratory in habit and breed in salt or brackish water. This explains the necessity of the extensive control work on the marsh lands of the districts in the San Francisco Bay region. These two species have a considerable range of flight and have been found 15 miles inland from any possible breeding ground.

OPEN MARSH LAND.

Open marsh land or land which is open to tidal flow is the simplest problem encountered, necessitating only the opening up of basins or depressions to tidal flow by means of drainage ditches. These drainage ditches remain open a number of years, being constantly flushed out by each successive tide. These ditches are about 18 inches wide and from 1 to 2 feet in depth. The access of the tide to the sloughs and depressions prevents the water from standing long enough to permit the completion of the life cycle of the mosquito. It also permits the entrance of small fish which devour the larvæ. Great tracts of land have thus been controlled by the construction of these ditches, which are usually dug by hand.

RECLAIMED LAND.

By far the most difficult problem encountered is in reclaimed land, especially reclaimed areas which, through neglect, have gradually formed natural breeding grounds. These abandoned levees and old leaky tide gates form a barrier which prevents the regular ebb and flow of the tide, resulting in accumulation of extensive areas of stagnant water, a most favorable condition for the breeding and hatching of salt marsh species. In contrast to the above neglected marsh areas are the reclaimed lands where the levees are maintained in good repair and the drainage canals and automatic tide gates (or pumping plants) are kept up to the highest point of efficiency. In these areas the control work consists, in the main, of drainage by the construction of a few ditches and the application of oil on the drainage canals to prevent the emergency of the early spring broods of *Aedes dorsalis* and *Aedis squamiger*.

It is customary in all the districts to solicit the cooperation of the land owners in order to accomplish the desired results. This cooperation takes many different forms of divided responsibility, such as the installation by the district of tide gates which are furnished by the land owners; plowing of cracked land by the owner or plowing partly paid for by the district and partly by the owners; the furnishing of power by the owner for pumping plants installed by the district, and in fact any equitable arrangement that is found satisfactory for the local problem involved.

In some instances, due to nonresident ownership or lack of appreciation of the value to be derived from efficient reclamation, it has been necessary for the district to assume entire control. On these areas, among which may be included the neglected areas above mentioned, the control work is accomplished in the cheapest manner possible and consists of temporary repair of broken levees, installation of tide gates, and oiling by the district.

TIDE GATES.

These gates for the control of drainage by permitting the water to flow out at low tide and automatically closing at high tide by preventing back flow are made of either wood or iron. The most efficient gate is a combination of corrugated iron culvert which is riveted to a cast iron flange on which is hung a cast iron gate suspended by two hinges. The first gate of this nature was built by the superintendent of the Three Cities Mosquito Abatement District in 1913. It was afterward patented by a commercial concern and is now being furnished in large quantities to drainage works of various kinds. The advantages of the above gate over the old wooden type are as follows:

1. The mud crabs will not burrow along the sides of the corrugated culvert.
2. The gate is ground to a tight joint with a flange, reducing leakage to a minimum.
3. The gate swings practically horizontally during flood water, allowing maximum flow through the pipe.
4. The economy of installation, because these gates can easily be installed with a crew of men between tides, the installation of a gate costing around $150.
5. The absence of warping found in all wooden structures exposed to alternating wetness and dryness.
6. The absence of rotting out as in the case of wooden gates.

CRACKED LAND.

Following the reclamation of tidal land and drainage of same, there is a shrinkage and sinking of the enclosed surface which produces extensive cracking in the surface of the land. These cracks are from 2 to 14 inches in width and often times 3 or more feet in depth. The water which accumulates in these cracks is very hard to drain out and water stands in them, offering an ideal condition for the breeding of mosquitoes. In fact it is often found that mosquitoes are breeding in cracks when there is no breeding in open waters. Even when pumping is resorted to the drainage from these cracks is very slow.

The oiling of such an area is an enormous job and a difficult undertaking, especially where grass grows over the cracks, making it difficult for the oil to reach the surface of the water below.

It has been found that the most efficient way to prevent breeding in such waters is to plow the land and fill the cracks by dragging and discing. The cost of such work varies with the type of land encountered; badly cracked land cut up by numerous sloughs will cost approximately $25 per acre, other areas costing between $12 and $15 per acre. The above work is done with heavy disc plows drawn by caterpillar tractors. The 60-horsepower seems to be the most efficient size to do this.

One concrete instance of cooperation between land owners and a mosquito abatement district is cited. The St. Vincent's Orphanage in Marin County had approximately 700 acres of such cracked land. This land had been used only for spring dry stock pasture for years and was an extensive breeder of mosquitoes. Oiling operations were costly and difficult, one season's oiling costing $1,800 on this area alone. A cooperative arrangement was agreed upon between the orphanage authorities and the trustees of the mosquito abatement district whereby the land was ployed, a levee and pumping plant repaired, at a total cost of $6,000. The 1925 crop of oat and barley hay from this land was valued at $13,000—a practical demonstration that reclamation and mosquito control go hand in hand. The oiling costs on this area in 1925 were $50 for oil used in the drainage canals alone.

PUMPING.

As mentioned above, there is a decided shrinking and settlement of the marsh land after reclamation and drainage have been accomplished. When the settlement is extensive it has been found necessary to resort to pumping in order to remove the last water from the bottom of the sloughs and drainage canals. The type of pump varies with the head encountered. Usually some form of low-lift pump is desirable. The Marin County Mosquito Abatement District owns and operates a vertical pump run by a 20-horsepower motor, pumping 3800 gallons per hour, installed at a total cost of $2,000. This pump in 1926 saved the district $1,000 in oiling cost.

OILING.

Oiling as a mosquito control measure should only be considered a temporary relief and a last resort to be used only in instances where permanent remedial measures are impossible. The oil used in the San Francisco Bay region is a mixture of crude oil with equal parts of "stove distillate." This makes a satisfactory oil and can be spread with knapsack pumps or power sprayers, and has sufficient body to accomplish death to the larvæ before it evaporates from the surface. Crude oil costs 5 cents a gallon, and "stove oil" 8 cents a gallon.

A number of different types of power sprayers are used from which spraying can be done directly from trucks at distances varying from 50 to 100 feet; some from pressure tanks, others from rotary oil pumps driven by gasoline engines or by power taken from the truck motor. Approximately all the oiling of the fresh water areas which are tributary to marsh lands is done with knapsack pumps. These are entirely inadequate when 500 to 600 acres are to be gone over. One instance where power spray pumps are used is on the property of the California Fruit Canners' Association. This ranch consists of 2000 acres and has 15 miles of drainage canals, every foot of which is covered with oil three or four times a year to prevent breeding.

CONCLUSIONS.

The public is satisfied with the results of the efforts put forward by the mosquito abatement districts as evidenced by the few complaints received at the offices of the districts.

The cost is low, averaging the owner of a five-room house assessed at $1,000, 80 cents a year.

Mosquito abatement has been partly responsible for the rapid growth in population and heavy expansion in real estate values in these areas, whereas before the districts were organized they were at a standstill.

MORBIDITY.*

Diphtheria.

187 cases of diphtheria have been reported, as follows: Berkeley 1, Hayward 1, Oakland 9, Piedmont 1, Butte County 2, Chico 2, Gridley 2, Colusa 1, Fresno County 1, Bakersfield 1, Los Angeles County 24, Burbank 2, Compton 1, Glendale 1, Huntington Park 2, Long Beach 7, Los Angeles 56, Pasadena 4, Lynwood 2, South Gate 1, Monterey County 1, Salinas 1, Orange County 2, Anaheim 2, Santa Ana 3, Corona 1, Sacramento 4, Ontario 1, San Bernardino 1, San Diego County 2, Escondido 1, San Diego 7, San Francisco 22, Lodi 1, Stockton 3, Burlingame 1, Redwood City 1, San Jose 1, Vallejo 1, Sonoma County

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*From reports received on December 6th and 7th for week ending December 4th.

2, Modesto 2, Tulare County 3, Lindsay 1, Yolo County 1, Marysville 1.

Measles.

809 cases of measles have been reported, as follows: Alameda County 7, Alameda 56, Albany 2, Berkeley 26, Oakland 216, Piedmont 5, Butte County 1, Chico 7, Colusa 6, Contra Costa County 6, El Cerrito 1, Fresno County 6, Bakersfield 1, Susanville 8, Los Angeles County 3, Long Beach 8, Los Angeles 6, Pomona 1, Madera 2, Marin County 3, Sausalito 1, Monterey County 18, Carmel 3, Salinas 39, Calistoga 1, Orange County 9, Huntington Beach 1, Plumas County 1, Riverside 1, Sacramento 43, Redlands 7, San Bernardino 34, San Diego County 1, National City 1, San Diego 7, San Francisco 79, San Joaquin County 19, Lodi 20, Stockton 52, San Luis Obispo County 9, Burlingame 2, Santa Barbara County 1, Santa Clara County 25, Palo Alto 4, San Jose 27, Vallejo 12, Sonoma County 1, Stanislaus County 12, Modesto 4, Tehama County 2, Dinuba 1, Yolo County 1.

Scarlet Fever.

217 cases of scarlet fever have been reported, as follows: Albany 1, Berkeley 8, Oakland 10, Butte County 3, Chico 1, Gridley 1, Contra Costa County 1, Pinole 2, Fresno County 1, Coalinga 1, Brawley 1, Kern County 6, Lassen County 1, Susanville 1, Los Angeles County 15, Alhambra 10, Arcadia 1, Compton 1, El Segundo 2, Glendale 3, Glendora 1, Huntington Park 2, Long Beach 13, Los Angeles 39, Pasadena 2, Pomona 1, Redondo Beach 1, South Gate 1, Maywood 1, Grass Valley 1, Orange County 3, Huntington Beach 4, Santa Ana 4, Riverside County 1, Corona 3, Sacramento 4, Ontario 1, San Bernardino 1, San Diego County 4, San Diego 13, San Francisco 12, San Joaquin County 2, Stockton 5, Tracy 2, Paso Robles 5, San Mateo County 1, Redwood City 1, Santa Barbara County 1, Santa Clara County 2, San Jose 5, Santa Cruz County 1, Healdsburg 1, Stanislaus County 3, Modesto 1, Turlock 1, Marysville 4.

Smallpox.

21 cases of smallpox have been reported, as follows: Oakland 6, Lake County 3, Los Angeles County 1, Los Angeles 4, Sacramento 2, San Joaquin County 2, Sonoma County 1, Marysville 1, California 1.

Typhoid Fever.

10 cases of typhoid fever have been reported, as follows: Humboldt County 1, Bakersfield 1, Los Angeles County 1, Los Angeles 1, Mendocino County 1, Daly City 1, Santa Cruz 1, Stanislaus County 2, Ceres 1.

Whooping Cough.

70 cases of whooping cough have been reported, as follows: Berkeley 16, Oakland 5, Piedmont 1, Los Angeles County 5, Alhambra 3, El Monte 3, Long Beach 4, Los Angeles 6, Pasadena 2, Monterey Park 1, Rialto 1, San Diego 2, San Francisco 14, Los Gatos 1, Watsonville 5, Dinuba 1.

Meningitis (Epidemic).

Two cases of epidemic meningitis have been reported, as follows: Oakland 1, Stockton 1.

Poliomyelitis.

Two cases of poliomyelitis have been reported, as follows: Glendale 1, San Luis Obispo County 1.

Encephalitis (Epidemic).

Three cases of epidemic encephalitis have been reported, as follows: Susanville 1, Modesto 1, San Joaquin County 1.

COMMUNICABLE DISEASE REPORTS.

Disease	1926				1925			
	Week ending			Reports for week ending Dec. 4 received by Dec. 7	Week ending			Reports for week ending Dec. 5 received by Dec. 8
	Nov. 13	Nov. 20	Nov. 27		Nov. 14	Nov. 21	Nov. 28	
Anthrax	0	0	0	0	0	0	0	0
Botulism	0	0	0	0	0	0	0	0
Beri-Beri	0	0	0	1	0	0	0	0
Chickenpox	256	318	302	381	173	246	217	241
Diphtheria	165	197	206	187	127	141	144	106
Dysentery (Bacillary)	0	0	6	2	4	0	0	2
Encephalitis (Epidemic)	1	0	2	3	3	0	4	1
Gonococcus Infection	85	115	69	96	81	239	118	98
Influenza	21	17	18	22	20	18	17	15
Jaundice (Epidemic)	2	0	0	0	0	0	0	0
Leprosy	0	0	0	0	1	0	0	1
Malaria	3	2	2	1	1	0	2	1
Measles	655	847	667	809	13	17	10	23
Meningitis (Epidemic)	1	0	3	2	2	3	0	4
Mumps	139	210	189	181	203	179	212	261
Paratyphoid Fever	0	0	2	0	1	2	1	1
Pneumonia (Lobar)	36	58	80	80	63	35	35	57
Poliomyelitis	2	6	5	2	17	13	10	2
Rabies (Animal)	13	10	7	4	3	5	2	3
Rabies (Human)	0	0	0	0	0	0	0	0
Rocky Mt. Spotted Fever	0	0	0	0	0	0	0	0
Scarlet Fever	291	305	262	217	124	170	171	129
Smallpox	46	14	10	21	66	41	55	42
Syphilis	84	120	87	152	105	200	96	126
Tetanus	2	1	1	0	2	1	1	1
Trachoma	4	15	4	191	3	17	2	3
Trichinosis	0	0	0	0	0	0	0	1
Tuberculosis	165	173	196	197	166	198	125	115
Typhoid Fever	19	13	14	10	14	17	17	6
Typhus Fever	0	0	0	0	0	0	0	0
Whooping Cough	79	103	59	70	56	30	55	45
Totals	2069	2524	2191	2629	1248	1572	1294	1284

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